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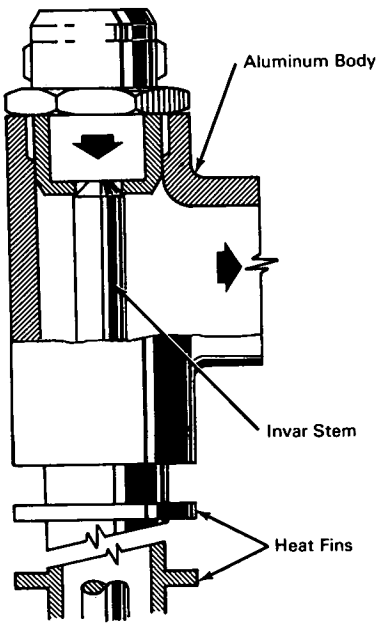
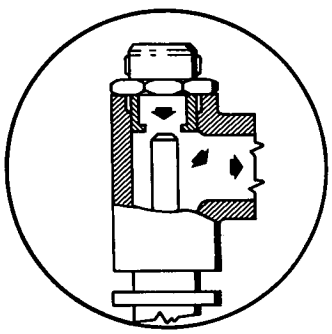
NASA TECH BRIEF

Cryogenic Trap Valve Has No Moving Parts



CLOSED CYCLE (BODY CONTRACTED)



OPEN CYCLE (BODY EXPANDED)

The problem:

To design a valve that keeps a cryogenic material in the liquid state as it enters the final component of a system. In existing systems using cryogenic materials, a solenoid or pneumatic vent valve is placed on the intake side of the component. This bleed valve is either opened periodically or remains partially open to be sure the cryogenic material enters the component in a liquid state. This procedure results in constant loss of the material. There is also a threat of failure due to the existence of moving parts and the dependence on external control systems.

The solution:

An aluminum-body trap valve that has a stem of invar. It functions as a self-actuated, self-monitoring valve because of the widely different coefficients of expansion between the aluminum body and invar stem.

How it's done:

The cryogenic-trap valve has no moving parts. The invar stem, located axially inside the valve body, is normally not seated when the body is at atmospheric temperature. The liquid entering these lines vaporizes and is released through the open trap valve exit

(continued overleaf)

port. As chilling progresses, the liquid is no longer vaporized in the supply line or in the valve body. As soon as liquid collects in the valve body, a rapid decrease in the body length will result from contraction of the body metal. Since the metal of the invar stem contracts very little, the end of the stem will contact the seat to interrupt the flow of the bleed. The valve body is finned for improved heat transfer from atmosphere to the entrapped liquid. This ensures reopening of the valve just prior to vaporization of the liquid in the supply line. Reopening of the valve initiates the bleed cycle for a very short interval.

Notes:

1. This development is in conceptual stage only, and as of date of publication of this Tech Brief, neither a model nor prototype has been constructed.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B66-10136

Patent status:

No patent action is contemplated by NASA.

Source: Lin W. Branum and Gerald Wells
of North American Aviation, Inc.,
under contract to
Marshall Space Flight Center
(M-FS-487)